

# PATENT SPECIFICATION



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## COMPLETE SPECIFICATION

### DRAWINGS ATTACHED

#### Improvements in or relating to Footwear

1, ALEXANDER ROSS FRASER, of 42, Hawkhill, Dundee, Angus, Scotland, a British Subject, do hereby declare the invention for which I pray that a patent may be granted to me and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to appliances for fitting to footwear and to footwear incorporating these appliances.

The object of the invention is to provide footwear with means which will operate to assist or replace the usual strap, lacing or the like in retaining and preventing slipping of the footwear on the wearer's foot.

With the foregoing object in view an appliance for footwear made in accordance with the invention comprises intercommunicating fluid containing chambers, one of which is disposed in the metatarsal area of the foot characterised by the feature that in use at least one of the chambers referred to is raised above the other chamber or chambers so as to be located opposite an upstanding part at the heel of the shoe or at the instep of the shoe or the like to which the appliance is to be fitted, the arrangement being such that during walking fluid is alternately expelled from one of said chambers into the other chamber or chambers thereby alternately inflating and deflating said chambers and preventing slipping of the foot in footwear to which the appliance is fitted.

The appliance may have an upstanding heel grip and at least one of the fluid containing chambers may be disposed in the heel grip, or two fluid chambers may be disposed in the tarsal or heel area on opposite sides of the heel grip.

The fluid containing chamber in the metatarsal area may be provided with a vent hole.

The interconnected fluid chambers may be incorporated in the footwear during manufacture thereof, or they may be incorporated in a "sock" or "insole" appliance to be separately fitted into the footwear. Alternatively, the intercommunicating fluid passage or passages alone may be formed in the footwear during manufacture thereof and the fluid chambers may be subsequently fitted to the shoe.

A valve may be incorporated in the metatarsal chamber and arranged to pump air from this chamber into the, or one, other fluid containing chamber.

In the accompanying drawings which illustrate how the invention may be carried into effect,

Fig. 1 is a perspective view of an appliance made in accordance with the invention and part of the heel of a shoe to which the appliance is to be fitted.

Figs. 2 and 3 are respectively sectional views taken on lines II-II and III-III, Fig. 1, Fig. 4 is a perspective view.

Fig. 5 is a view in cross section of the foot portion of a Wellington or gum boot made in accordance with the invention, and

Figs. 6 and 7 respectively illustrate two modifications which may be incorporated in a device according to the invention.

The appliance shown in Figs. 1 to 3 of the drawings comprises a rubber strip comprising two superposed layers 10<sup>1</sup>, 10<sup>2</sup> (see Fig. 3) shaped substantially in accordance with the human foot and provided with an upstanding heel grip 11 and with one air chamber 12 (referred to hereafter as the "metatarsal air chamber") which is located when the appliance is fitted in the footwear under the metatarsus of the foot and two air chambers 13, 14 (referred to hereafter as the "tarsal air chambers") located respectively

on opposite sides of the upstanding heel grip 11 so as when fitted in a shoe or like article of footwear to be disposed opposite the fleshy hollows usually present anteriorly on the medial and lateral aspects of the heel bone of the foot. The metatarsal air chamber 12 contains a foam rubber pad 12' and is connected by air ducts or channels 15, 16 to the two tarsal air chambers 13, 14. The reference numeral 17 denotes part of the heel of a shoe in which the appliance is fitted.

An appliance according to the invention may be made separately from the shoe or like footwear in which it is to be incorporated, or it may be incorporated in the sole of the shoe or the like so as to form an integral part thereof. When the appliance is made separately from the footwear it may be fitted loosely therein in the manner of a conventional removable sock or insole, or it may be adhesively secured to the inner sole or lining, or both, of the shoe.

When the appliance is loosely fitted for use as a removable sock or insole, the outer surfaces of the air chambers 13, 14 which in use oppose the inner aspect of the counter surface of the heel of the footwear and other parts which come into contact with the shoe should preferably be formed with an irregular or rough surface which will engage frictionally with the opposing surfaces of the shoe, and thereby oppose movement of the appliance relatively to the shoe, thus serving to retain the appliance in its correct position in the shoe. Further, the outer walls of the inflatable chambers 12, 13, 14 are preferably made thicker or stronger than the inner walls so that the inner walls will be more flexible and will bulge inwardly when the chambers are inflated in the manner hereafter described.

The arrangement is such that when, during walking, pressure is applied on the metatarsus of the foot air in the metatarsal air chamber 12 is expelled and forced through the ducts 15, 16 into the tarsal air chambers 13, 14 which expand and bulge inwardly and thereby provide a firm grip on the wearer's foot, preventing upward and forward slipping thereof in the shoe or the like, whilst when the pressure is removed from the metatarsus of the foot of the air in the two tarsal air chambers 13, 14 flows back into the chamber 12.

An incidental advantage arising in cold weather from thus gripping the footwear on the foot will be to reduce or prevent the flow of cold air between the heel of the shoe and the heel of the wearer into the footwear, thus keeping the foot warmer in cold weather.

A vent hole 18 may be provided and located in the top wall of the metatarsal air chamber 12 so that it is at times substantially sealed by the foot. When such a

vent hole is provided a small part of the air expelled during walking from the chamber 12 will be expelled through this vent hole and will be replaced by fresh air, and this intermittent air replacement will tend to keep the foot cool during hot weather.

In the embodiment above described and illustrated in Figs. 1 to 3 each of the layers 10', 10<sup>2</sup> may comprise a single strip or a plurality of laminations built up into a strip. The embodiment described can be made on a last representing a plaster model of a human foot, the surface of this last being formed with a depression at the place corresponding to the metatarsus of the foot where chamber 12 is to be formed. A strip of rubber i.e. the strip 10', comprising one or more laminations is processed on to the last the part of this strip opposite the depression above referred to being moulded into this depression, thereby producing a corresponding depression in the rubber strip. When the rubber to the desired thickness is consolidated on the model a V-shaped piece of waxed thread or wire is placed on the rubber strip with its apex projecting into the metatarsal depression, one side of the thread extending between the metatarsal depression and the place where the tarsal chamber 13 is required in the heel grip, and the other side of the thread extending between the metatarsal depression and the place where the other tarsal chamber 14 is required in the heel grip. Separate thin discs of rubber 20, 21 (Fig. 2) which will not adhere on their inner aspect, are now placed over the ends of the thread or wire and sealed to the main rubber strip 10' to form the chambers 13, 14 whereupon a second rubber strip i.e. the strip 10<sup>2</sup> is processed over the strip 10' first laid on the last, and is sealed thereto from the heel end up to near the closed apex of the thread or wire. The apex of the thread or wire is now gripped and withdrawn from between the two layers 10', 10<sup>2</sup> of rubber, the pad 12' of sponge rubber is now inserted in the metatarsal depression and the front portion of the second strip of rubber is processed over the corresponding part of the first strip. The appliance is subsequently removed from the last and trimmed to the required shape and size. When the vent hole 18 is to be provided this hole can best be provided after the appliance has been removed from the last.

In the method above described the last comprising a plaster model of the human foot may be regarded as a positive model. This positive model may be replaced by a negative model representing the inner parts of a shoe with which the appliance would come into contact. When using such a negative model the method would be similar to that above described, but in this case no

depression would be required for forming the metatarsal chamber 12 which could then be formed simply by placing the rubber pad 12' in the required position on the strip 10<sup>2</sup>.

The appliance may be made in other ways. For example the appliance could be moulded from a synthetic plastic, and the two tarsal air chambers 13, 14 may be replaced by a single chamber extending partly or completely around the heel grip 11. In this last construction only a single air passage need be provided between the tarsal and metatarsal air chambers.

Figs. 4 to 5 illustrate how an appliance made according to the invention can be incorporated in a rubber boot, e.g. a Wellington or gum boot. In this embodiment two air chambers are provided in the inner surface of the boot, namely a metatarsal chamber 22 located in the insole of the boot opposite the metatarsal area of the foot, and a second chamber 23 located on the inner surface of the front of the boot opposite the ankle. A duct 24 extends between so as to provide communication between these chambers. A vent hole (not shown) similar to the vent hole 18 may be provided in either one, or in both, of the air chambers.

If desired and as shown in Fig. 6 the vent hole 18 in the metatarsal chamber 12 (Fig. 1) or 22 (Fig. 5) may be controlled by a valve 25. When such a valve is provided and pressure is exerted on the chamber 12 or 22, during walking, the valve would be pressed into or towards the closed position and would prevent the escape of air through the hole 18 and thus retard the escape of air through this hole, and promote the flow of air through the duct 24 into the chambers 13, 14 (Fig. 1) or into the chamber 23 (Fig. 5). The valve 25 is a loose fit and will allow the entry of air when the weight of the body is taken off it.

Instead of providing a rubber pad 12' in the chambers 12 or 22 one wall of this chamber may be formed on its inner surface with a plurality of pinnacles 26 as shown in Fig. 7 which are pressed during walking against the other wall of the chamber and serve when the pressure is released to again space the two walls apart.

In both the embodiments described and illustrated in the drawings instead of containing air the inflatable chambers may contain a liquid, a vent hole such as 18 then being omitted. Further, the chamber 12 (Fig. 1) or 22 (Fig. 4) may be and preferably is shaped to support the metatarsal arch of the wearer's foot, and an arch support for the longitudinal arch of the foot can be incorporated in the strip if desired.

#### WHAT I CLAIM IS:—

1. An appliance for footwear comprising

intercommunicating fluid containing chambers, one of which is disposed in the metatarsal area of the foot characterised by the feature that at least one of the chambers referred to is raised above the other chamber or chambers so as to be located opposite an upstanding part at the heel of the shoe or the instep of the shoe or the like to which the appliance is to be fitted, the arrangement being such that during walking fluid is alternately expelled from one of said chambers into the other chamber or chambers thereby alternately inflating and deflating said chambers and preventing slipping of the foot in the footwear to which the appliance is fitted.

2. An appliance according to claim 1 wherein the appliance has an upstanding heel grip and at least one of the fluid containing chambers is disposed in the heel grip.

3. An appliance according to claim 1 wherein the appliance has an upstanding heel grip and two fluid chambers are disposed in the tarsal or heel area and on opposite sides of the heel grip.

4. An appliance according to any one of claims 1 to 3 wherein the fluid containing chamber in the metatarsal area is provided with a vent hole.

5. An appliance according to claim 4 wherein the vent hole is controlled by a valve.

6. Footwear fitted with an appliance according to any one of claims 1 to 5.

7. An appliance according to any one of claims 1 to 3 wherein the fluid contained in the chamber is a liquid.

8. Footwear having incorporated therein during the course of manufacture an appliance according to any one of claims 1 to 7.

9. The method of making an appliance according to any one of claims 1 to 4 substantially as described herein.

10. An appliance for fitting to footwear substantially as described herein with reference to and as illustrated in Figs. 1 to 3 of the accompanying drawings.

11. A boot fitted with intercommunicating fluid containing chambers substantially as described with reference to and as illustrated in Figs. 4 and 5 of the accompanying drawings.

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# PROVISIONAL SPECIFICATION

## Improvements in or relating to Footwear

I, ALEXANDER ROSS FRASER, of 42, Hawkhill, Dundee, Angus, Scotland, a British Subject, do hereby declare this invention to be described in the following statement:—

5 This invention relates to footwear.

The object of the invention is to provide footwear fitted with means which will operate to assist the usual strap, lacing or the like in retaining and preventing slipping of the footwear on the wearer's foot.

With the foregoing object in view footwear made in accordance with the invention is fitted with interconnected fluid containing chambers so disposed respectively that when the footwear is worn at least one of the chambers is disposed in the metatarsal area of the foot and at least one is disposed in the tarsal or heel area of the foot, the arrangement being such that during walking fluid is alternately expelled from one chamber into the other chamber in a direction in which the chamber thus inflated acts to prevent slipping of the foot in the footwear.

The interconnected fluid chambers may be incorporated in the footwear during manufacture thereof, or they may be incorporated in a "sock" or "insole" appliance to be separately fitted into the footwear. Alternatively, the interconnecting fluid passages alone may be formed in the footwear during manufacture thereof and the fluid chambers may be subsequently fitted to the shoe.

In a preferred way of carrying the invention into effect the interconnected fluid chambers are formed in an appliance arranged to be detachably or otherwise fitted in the footwear.

In one embodiment the appliance comprises a strip of material shaped substantially in accordance with the human foot and provided with an upstanding heel grip and with one air chamber (referred to hereafter as the "metatarsal air chamber") which is located when the appliance is fitted in the footwear under the metatarsus of the foot and two air chambers (referred to hereafter as the "tarsal air chambers") located respectively on opposite sides of the upstanding heel grip so as when fitted in the footwear to be disposed opposite the fleshy hollows usually present anteriorly on the medial and lateral aspects of the heel bone, the metatarsal air chamber being connected by air channels to the two tarsal air chambers.

The arrangement is such that when, during walking, pressure is applied on the metatarsus of the foot air in the metatarsal air chamber is expelled and forced into the tarsal air chambers which expand and there-

by grip the footwear firmly on the wearer's foot, preventing upward and forward slipping thereof, whilst when the pressure is removed from the metatarsus of the foot the air in the two tarsal air chambers flows back into the metatarsal air chamber which is thereby inflated and prevents the wearer's foot from slipping forwardly in the shoe or the like.

An incidental advantage arising from thus gripping the footwear on the foot will be to reduce or prevent the flow of air past the heel into the footwear thereby keeping the foot warmer in cold weather.

A vent hole may be provided in the metatarsal air chamber to assist the operation. Part of the air expelled from the metatarsal air chamber will be expelled through this vent hole and will be replaced by fresh air, and the circulation of air between the chambers will tend to keep the foot cool during hot weather.

The front portion of the strip is preferably shaped to support the metatarsal arch, and an arch support for the longitudinal arch of the foot can be incorporated in the strip if desired.

In one way of making the appliance referred to in the above embodiment the shaped strip of material is made by moulding rubber on a mould having secured thereto two strips of stainless steel spring wire suitably located to provide two air channels through the moulded strip. The metatarsal and tarsal air chambers are made separately and adhesively secured to the moulded strip so that the metatarsal chamber is in communication with both air channels at one end thereof, whilst the two tarsal air chambers are respectively in communication each with one of the air channels at the other end thereof. The metatarsal air chamber and/or the tarsal air chamber may be packed if desired with sponge rubber or other suitable resilient material before it is fixed to the moulded strip in order to impart greater resistance to pressure and to assist in returning the chamber to its natural shape when pressure thereon is removed.

The embodiment above described may be modified in many ways. For example, the appliance could be moulded from a synthetic plastic, and the two tarsal air chambers may be replaced by a single chamber extending around the heel grip. In this modified construction only a single air passage may be provided between the tarsal and metatarsal air chambers.

In another modification instead of containing air the inflatable chambers may con-

tain a liquid, the vent hole above described then being eliminated.

In yet another modification the heel grip is eliminated and the tarsal chamber or 5 chambers is or are incorporated in the heel portion of the flat strip or of the shoe.

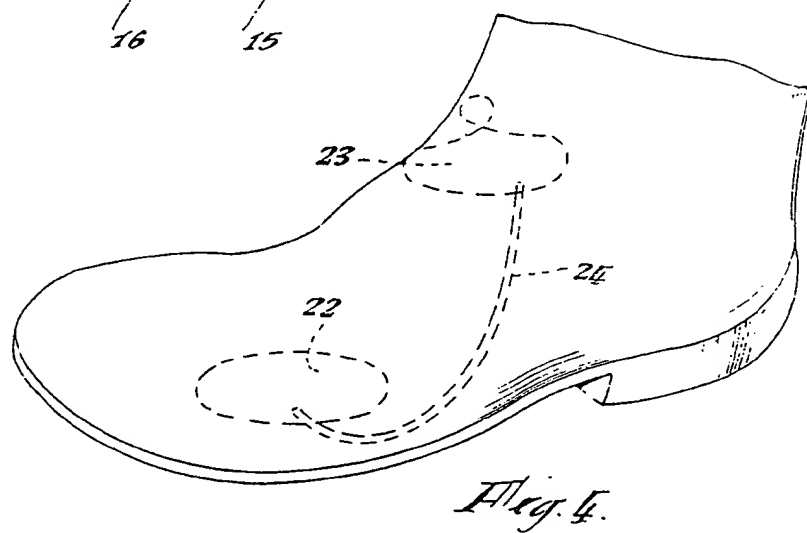
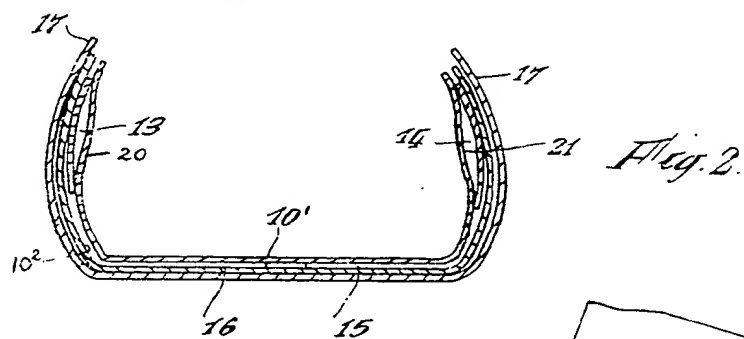
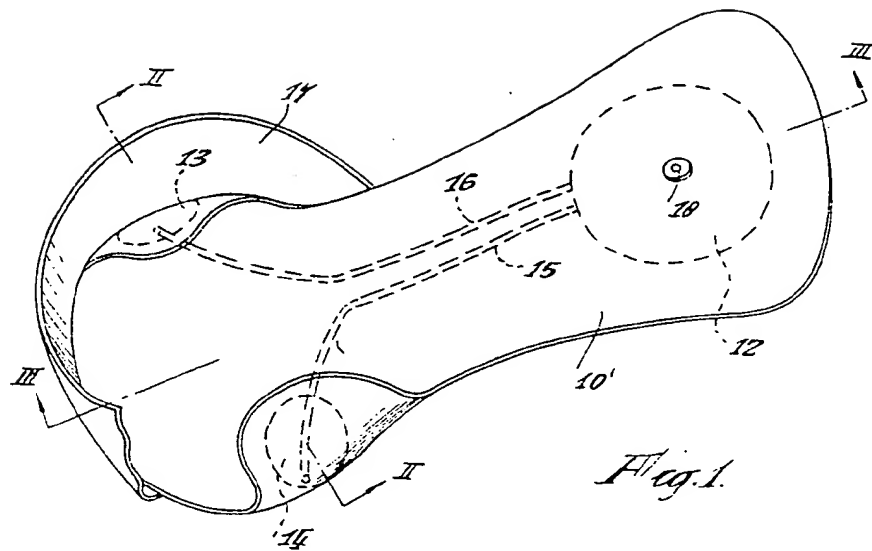
An appliance made according to the invention could also be incorporated or fitted

in footwear for the purpose of retaining insoles in position.

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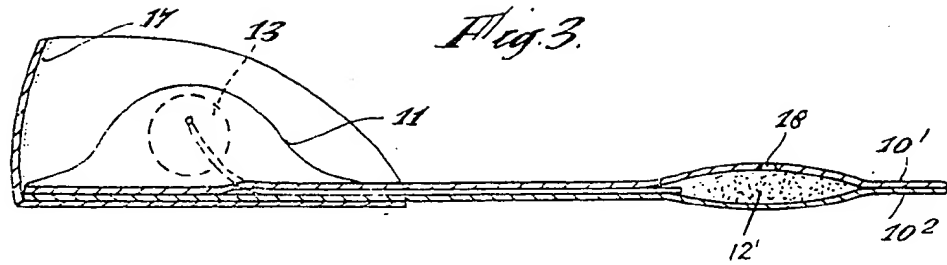
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COMPLETE SPECIFICATION

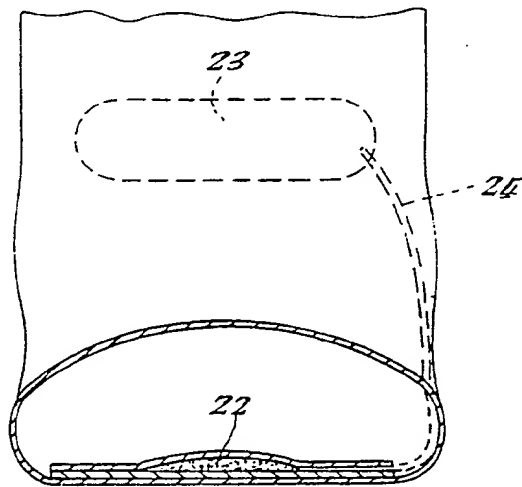
2 SHEETS

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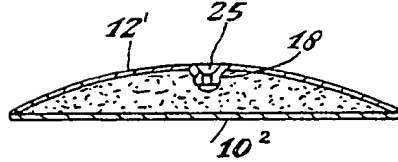
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*Fig. 5.*



*Fig. 6.*



*Fig. 7.*

